

“TOO MUCH OF A GOOD THING?” EXAMINATION OF PROXY RELIANCE AND
GENDER IN ADHERENCE TO CARDIAC REHABILITATION

By

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ABSTRACT

With 1.4 million Canadians living with heart disease, cardiac rehabilitation (CR) programs are considered an essential component of the healthcare system and the overall care of patients following a cardiac incident (Daly et al., 2002). The exercise therapy component of cardiac rehabilitation (CR) not only aids improvements in physical function, but also assists participants in their return to work and everyday life activities. Although CR helps to reduce patients' risk of future cardiac events, exercise adherence is suboptimal in CR programs and continues to decline following program completion. The decline of self-managed (SM) exercise following CR suggests patients may be unprepared for maintaining the exercise that initially lowered their cardiac risk. One psychological factor that may contribute to the issue of non-adherence to SM-exercise is CR participants' reliance on CR staff, known as proxy reliance. Staff function as agents to assist and guide participants, however a downside to strong patient management is the potential over-reliance on CR staff. Over-reliance may contribute to participants' inability to SM-exercise following CR completion. This phenomenon can be understood through the agency aspect of Bandura's social-cognitive theory (SCT; Bandura, 1986). Individuals who enlist a proxy develop efficacy beliefs for their proxy, known as proxy efficacy (Bandura, 1997). Although proxy efficacy can help build one's own personal sense of efficacy for behaviour (i.e., SM-exercise), the dilemma of proxy reliance becomes apparent the more the proxy is used (SCT; Bandura, 1997). Bandura (1997) suggests reliance upon high levels of assistance from a proxy may actually reduce individuals' opportunities for mastery experiences, resulting in an inability to develop self-regulatory behaviour (Shields & Brawley, 2007). Using Bandura's (1986) SCT, the primary purpose was twofold. The first purpose of the present study was to examine social-cognitive and behavioural differences over time among individuals with *high proxy* reliance.

Further, CR participants *high* and *low* in proxy reliance were also compared relative to social-cognitive and behavioural variables. Bandura (1997) has also noted differences in relinquishing control between men and women, with women more willing to yield control to others who they believe can manage the situation better. Additionally, women are often underrepresented in CR programs and have been identified as the most vulnerable to attrition (Sedlak & Humphries, 2016). To date, no research has investigated potential gender differences in proxy reliance. Also, given that gender differences have been observed in CR exercise adherence literature, the secondary purpose was to explore participants' CR entry characteristics, proxy reliance, and adherence. The study design was prospective observational. Eighty-nine CR participants ($M_{\text{age}} = 64.5$, 32.6% female) who agreed to participate were followed over a usual care 12-week CR program, and for one-month of self-management post-CR. Participants completed measures of proxy reliance, self-regulatory efficacy (SRE) for scheduling and planning exercise (SP), SRE SM-exercise options (SRE-SMO), anticipated persistence for SM-exercise, exercise difficulty, and volume of SM-exercise. Assessments were completed at multiple time points throughout the course of study participation. Individuals with high proxy reliance had a significant decline in their persistence for SM-exercise from the end of CR to one-month following the end of the CR program. One-month post-CR, their number of SM-exercise options also differed. Significant differences were also found between individuals high and low in proxy reliance for volume of SM-exercise and number of SM-exercise options. A noticeable post-CR decline was found in both high and low proxy individuals' SRE-SP and persistence. Comparisons between men and women indicated no differences in proxy reliance and no differences in study adherence. The exploration of baseline gender differences in health variables indicated that women reported significantly greater anxiety at the start of CR and a greater number of comorbidities.

Exploration of baseline gender differences regarding social-cognitive variables indicated women had lower SRE-SP, greater exercise difficulty, and fewer SM-exercise bouts. Health variable differences were similar to those found in previous gender-based literature (e.g., Oosenbrug et al., 2016). Regarding primary study purposes, results follow Bandura's theorizing regarding the dilemma of proxy reliance. A risk of decline in exercise self-management was evident for those who rely more on CR staff. Individuals with high proxy reliance exhibit greater difficulty in self-managing exercise post-CR. Findings of the present study not only provide questions for future research but also potential implications for training of CR staff.

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TABLE OF CONTENTS

PERMISSION TO USE	I
ABSTRACT.....	II
ACKNOWLEDGEMENTS	V
LIST OF APPENDICES	VIII
LIST OF FIGURES	IX
LIST OF TABLES	X
INTRODUCTION	1
PROBLEMATIC ADHERENCE OF CR PROGRAMS	1
LACK OF SELF-REGULATORY SKILLS	2
DILEMMA OF OVER-RELIANCE	4
PROXY RELIANCE AND SELF-REGULATION.....	6
GENDER.....	6
PRIMARY AND SECONDARY PURPOSES.....	8
HYPOTHESES.....	9
METHODS.....	10
PARTICIPANTS AND DESIGN	10
MEASURES.....	14
<i>Proxy reliance</i>	<i>15</i>
<i>SRE for exercise scheduling and planning.....</i>	<i>15</i>
<i>Anticipated persistence</i>	<i>16</i>
<i>Volume of exercise.....</i>	<i>16</i>
<i>Perceived exercise difficulty</i>	<i>17</i>
<i>Number of SM-exercise options post-CR and SRE for SM-exercise options.....</i>	<i>17</i>
<i>The Hospital Anxiety and Depression Scale.....</i>	<i>18</i>
STUDY PROTOCOL	19
ANALYTICAL PLAN	20
DATA SCREENING AND CLEANING	20
ANALYSES	21
<i>Proxy reliance differences.....</i>	<i>22</i>
<i>Gender differences.....</i>	<i>23</i>
<i>Adherer versus non-adherer differences.....</i>	<i>24</i>
RESULTS	25
HIGH PROXY RELIANCE.....	25
<i>Proxy reliance at baseline.....</i>	<i>25</i>
<i>Proxy reliance after 10-weeks of CR experience.....</i>	<i>26</i>
HIGH VERSUS LOW PROXY RELIANCE.....	28
<i>Proxy group comparisons at baseline.....</i>	<i>28</i>
<i>Proxy group comparisons after 10-weeks of CR experience.....</i>	<i>29</i>
GENDER DIFFERENCES.....	30
<i>Baseline demographic and health variables.....</i>	<i>30</i>
<i>Baseline social-cognitive differences.....</i>	<i>31</i>
<i>Gender by proxy reliance comparisons.....</i>	<i>33</i>

ADHERENCE IN CR	35
DISCUSSION.....	37
THE PRESENT STUDY IN CR CONTEXT	37
HIGH PROXY RELIANCE.....	38
HIGH VS. LOW PROXY RELIANCE.....	39
GENDER DIFFERENCES.....	41
ADHERENCE IN CR	42
RELEVANCE OF FINDINGS	43
STRENGTHS	44
LIMITATIONS	44
NEW DIRECTIONS.....	45
CONCLUSION.....	47
REFERENCES	48
APPENDIX.....	57

LIST OF APPENDICES

Appendix A: Study Questionnaires.....	57
Appendix B: Internal Consistency Reliabilities of Measures.....	74
Appendix C: Participant Demographics and Health-related Problems.....	75
Appendix D: Comparisons of Proxy Reliance Groups at 10-weeks of CR.....	76

LIST OF FIGURES

Figure 1. Participant Recruitment and Attrition Throughout the Study.....	12
Figure 2. Gender by Proxy Reliance Interaction on the Volume of SM-exercise: One-month Post-CR.....	35

LIST OF TABLES

Table 1. Male and Female Characteristics of the Sample at CR Entry.....	14
Table 2. Prospective Design Assessment Timeline.....	19
Table 3. Individuals with High Proxy Reliance at Baseline: Responses to Self-management.....	26
Table 4. Time 2 High Proxy Reliance: Responses to Self-management.....	28
Table 5. Baseline Demographic and Health Differences between Males and Females.....	31
Table 6. Baseline Social-cognitive Differences Between Males and Females.....	32
Table 7. Time 4 Social-cognitive and Time 2 Behavioural Differences between Males and Females.....	33

Introduction

Cardiovascular disease (CVD) continues to be the leading cause of morbidity and mortality in both men and women, with heart disease accounting for one quarter of all deaths in the developed world (Daly et al., 2002; Julian, 1995; Government of Canada, 2015). Following a myocardial infarction, participation in cardiac rehabilitation (CR) facilitates recovery and enables patients to achieve better health including reduced risk of future cardiovascular events. More specifically, in the first year of recovery, cardiovascular mortality can be reduced by approximately 25% when patients participate in exercise-based CR (Daly et al., 2002; Wenger, Froelicher, Smith et al., 1995). The exercise therapy component of CR not only aids improvements in physical function, but also assists participants in their return to work and everyday life activities (Canadian Association for Cardiac Rehabilitation (CACR; Stone, Arthur & Suskin, 2009).

With 1.4 million Canadians living with heart disease, CR programs are considered an essential component of the healthcare system and the overall care of patients following a cardiac event (Daly et al., 2002). In a meta-analysis (e.g., Taylor et al., 2004) of 48 exercise-based CR programs, participation was associated with a significant reduction in modifiable risk factors, and a reduction in both cardiac and all-cause mortality when compared to usual care.

Problematic Adherence of CR Programs

In healthcare settings, adherence within treatment programs and following them is a function of the collaborative relationship between the patient and the healthcare provider. Such a relationship provides opportunity for patients to learn how to develop self-managed (SM) exercise regimens that are realistic for their abilities and lifestyle (Gierc, Brawley, & Rejeski, 2016). Despite the positive documented benefits of CR programs, adherence is suboptimal with

an average dropout rate of 24-50% (Turk-Adawi, Oldridge, Tarima, Stason, Shepard, 2013). Patterns of increasing attrition to CR programs have been shown within the first 3-6 months (Daly et al., 2002), with more than 50% of participants exhibiting a decline in exercise within 6 months of finishing CR (Moore et al., 2006). As participants progress over longer periods of time beyond CR, participation rates continue to decline (e.g., Moore et al, 2006), suggesting independently participating in exercise following CR can be challenging.

The decline of SM-exercise following structured CR suggests patients may be unprepared for maintaining the exercise that initially lowered their cardiac risk. Non-adherence is concerning as CR has been established as dose-dependent with regular participation essential for sustaining the benefits of CR (Oosenbrug et al., 2016). Women and men are found to experience similar benefits for exercise function; however, women comprise only 20% of the populations studied in CR, with the rate of enrolment and adherence much lower for women than their male counterparts (e.g., women's rates of enrollment are 10-40% below men's; Gallagher et al., 2003). Research supports evidence of differential rates of referral and adherence between men and women; however, reasons for the difference remains poorly understood, with only some explanations being lack of interest, arthritis, multiple co-morbidities, transportation issues, and family obligations (Marzolini, Brooks, and Oh, 2008). Without strong advisement and support to CR patients, Sedlak and Humphries (2016) suggest that low enrolment and poor adherence will continue, notably for those apparently most vulnerable to attrition -- women.

Lack of Self-Regulatory Skills

One psychosocial factor that has been examined in relation to adherence in CR is self-efficacy. Self-efficacy refers to “beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments” (Bandura, 1997, p.3). Efficacy beliefs play a

role in sustaining adherence to exercise by influencing one's choice of activities, effort expended, and persistence in the face of obstacles (Bandura, 1997). Greater self-efficacy is associated with higher levels of exercise adherence in both healthy and diseased populations (i.e., CR patients; Bandura, 1997; Ewart, 1995).

Before adherence to CR can be sustained, individuals must learn to self-regulate their behaviour. Self-regulation is a key tool for self-management of exercise and positive health behaviour. It is defined as the “ability to derive strategies and alter behaviour in order to reach a goal “(Gierc, Brawley, & Rejeski, 2016). For patients enrolled in CR programs, this goal may be to increase exercise, improve overall fitness and reduce cardiovascular risk factors. Following CR, program staff recommend individuals continue with their exercise and suggest goals of pursuing public health recommendations for exercise to accrue health benefits (e.g., 150 minutes per week; Price et al., 2016). With positive patient results from CR programs, the issue of non-adherence following CR is perplexing and ultimately not well understood. However, a lack of the necessary self-regulatory skills to effectively manage independent exercise following CR has been suggested as one reason for the adherence decline (e.g., Brawley, Flora, Locke & Gierc, 2016; Brawley, Rejeski & King, 2003; Rejeski, Brawley & Jung, 2008).

Self-regulatory efficacy (SRE) involves individuals' confidence in their skills and abilities to exercise control over themselves in order to regularly achieve a desired outcome (Bandura, 1986; Maddux & Gosselin, 2003). Less efficacious individuals will have lower persistence and will exert less effort in their self-regulation of exercise, leading to potential non-adherence. Bandura (1997, p. 411) has stated that among the individuals who try to exercise regularly, those of weaker efficacy become poor adherers.

In randomized control exercise trials (RCT) of CR participants engaged in exercise plus group-mediated cognitive behaviour (GMCB) change strategies (Brawley, Flora, Locke & Gierc, 2014), participants had superior outcomes compared to those in standard care CR. Specifically, GMCB participants have shown improved physical function, bettered adherence, maintenance of exercise, and improved and sustained self-confidence to independently manage exercise (e.g., Rejeski et al, 2003). These results are positive and were evident after six plus month's post-CR of participants engaging in SM-exercise.

Dilemma of Over-Reliance

A unique, but related factor that may also contribute to the issue of non-adherence to SM-exercise is CR participants' reliance on CR staff. Staff help manage and guide participants through a structured 12-week CR program, while providing them with evidence-based instruction (Canadian Association of CR [CACR, 2009]) about safe, graded exercise therapy, monitoring, education about disease, risk, and lifestyle changes. Although CR staff function as agents to assist and safely guide new participants, there is a downside of potential over-reliance by participants on CR staff during their program.

Strong management by CR staff helps participants throughout their initial rehabilitation, however, things may become difficult when participants begin to transition to independent SM-exercise. If over-reliance is the case, at the time of program completion participants will not have had the opportunity to develop the skills or mastery experiences required to self-manage and adhere to exercise without the help of CR staff. From a psychological and behavioural perspective, this phenomenon can be understood through the agency aspect of Bandura's social-cognitive theory (SCT; Bandura, 1986). The exercise of personal agency carries a great deal of responsibility and risks (Bandura, 1997), often resulting in CR initiates turning to CR staff for

help in managing their exercise. More specifically, proxy agency involves relinquishing control to a powerful or knowledgeable third party (i.e., CR staff) to act with or on one's behalf to help bring about desired outcomes (i.e., reduce cardiac risk and increase exercise; Bandura, 1997).

Individuals who enlist a proxy agent to help them manage their exercise behaviour may do so for one of three possible reasons (Bandura, 1997). First, individuals may not possess the personal means to achieve their desired outcomes (i.e., self-efficacy). Second, individuals may possess the skills for goal attainment; however, they turn to a proxy because they feel the agent can more effectively assist in the achievement of their desired outcomes. Third, while individuals may be capable of exerting direct control over their outcomes, they may choose another individual to take control because they do not want the responsibility or potential consequences that come with direct control.

Individuals, who enlist a proxy for one of the reasons mentioned, develop efficacy beliefs for their proxy (Bandura, 1997). Proxy efficacy can be defined as patients' confidence in proxy agents' abilities to provide assistance to help in the performance of a task and/or self-regulatory behaviours (Shields & Brawley, 2007). In the CR context, this refers to patients' efficacy in CR staff to work with or for them in regard to their exercise.

Although proxy efficacy can help build one's own personal sense of efficacy for behaviour (i.e., SM-exercise), the dilemma of proxy reliance becomes apparent the more the proxy is used (SCT; Bandura, 1997). For example, a preference for frequent contact with CR staff has shown to create a sense of reliance on these proxies by participants (Shields & Brawley, 2006). Over-reliance on the proxy may be an unfortunate and unintended consequence of CR that may contribute to the issue of non-adherence.

Proxy Reliance and Self-Regulation

The problematic consequences of proxy reliance become evident when individuals are confronted with the behavioural challenge of self-managing exercise following CR graduation. Previous exercise research offers evidence about the dilemma of over-reliance on the proxy relative to the problem of non-adherence to SM-exercise. For example, Shields and Brawley (2006) have shown that individuals who prefer high assistance for a proxy agent to help them manage their exercise have lower self-regulatory and task efficacy when faced with having to exercise without the proxy compared to their low preferred-assistance counterparts. Bray, Brawley and Millen (2006) found strong reliance on staff in the late weeks of the CR program to be inversely related to self-regulatory efficacy for managing home-based exercise.

Bandura (1997) suggests reliance upon high levels of assistance from a proxy may actually reduce individuals' opportunities for mastery experiences, resulting in an inability to develop self-regulatory behaviour (Shields & Brawley, 2007). In the GMCB RCTs reported earlier, participants receiving enhanced CR (i.e., taught self-management skills) compared to standard care CR maintained SM-exercise 6 month's post-CR. These latter results suggest that standard CR, although effective for risk reduction, did not help individuals learn to self-regulate their exercise.

Gender

A great deal of literature has focused on the issues of non-adherence among CR participants and the detrimental effects on related health outcomes. Several individual characteristics continually arise in relation to adherence (i.e., age and employment; Mikkelsen, Thomsen, & Tchijevitch, 2014). One factor that consistently arises is the significant difference in dropout rate between men and women (Brezinka & Kittel, 1996; Daly et al., 2002).

The combined attendance rates for men and women are low, however, in a recent meta-analysis of adherence in CR, women accounted for only 27.3% of total participants in CR (Oosenbrug et al., 2016). The lack of female representation in CR programs is concerning as women experience similar benefits for exercise function as men; however, participation in CR may offer women additional benefits, as they are often older when first diagnosed with coronary heart disease (Gallagher, McKinley, & Dracup, 2003).

In the recent meta-analysis by Oosenbrug et al (2016), CR adherence in Canadian studies ranged from 36.7% to 84.6%, with a significant difference in which men adhered to more sessions than women. Gender differences were especially apparent in Canadian studies published after 2010. Results suggest gender differences in CR programs start to diverge over time, particularly in programs longer than 12 weeks in duration and in programs with fewer than 3 sessions/week (Oosenbrug et al, 2016).

Psychosocial benefits of CR programs have been investigated more extensively in men than in women (Focht, Brawley, Rejeski, & Ambrosius, 2004). Upon entry into CR programs, women are found to exhibit poorer psychosocial profiles, lower attendance and demonstrate significantly greater attrition. From previous studies, it is evident that the relation of exercise to psychological well-being and subjective health may be moderated by gender and baseline level of mental health (i.e., anxiety; Focht et al., 2004). Additionally, Bandura (1997) has noted differences in relinquishing control between men and women, with women more willing to yield control to others who can manage the situation better, but to date no research has investigated potential gender differences in proxy reliance. From a health promotion perspective, control differences between males and females have implications for health-related quality of life (HRQoL) and well-being.

Primary and Secondary Purposes

Current research about factors limiting adherence to exercise and issues of proxy reliance among CR patients suggests there are unintended post-CR consequences of prescriptive instruction provided by CR staff. One consequence may be the limitation of not readying participants for life that requires self-management and the maintenance of exercise for sustained prevention of morbidity. Consequently, patients' confidence to self-regulate their own exercise outside of CR may suffer as a consequence of their level of dependency on the proxy.

The primary study purpose was twofold. The first was to examine differences over time among individuals reporting *high proxy* reliance to determine if there is a change in the strength of social-cognitive variables and behaviour. The second was to compare CR participants *high and low in proxy reliance* with respect to the same variables.

A secondary research purpose was to *explore gender differences* relative to baseline characteristics, proxy reliance, and adherence. Gender differences were explored to (a) determine whether baseline characteristics were different among males and females, (b) whether proxy reliance differed between males and females, and (c) explore adherer-dropout differences between males and females. Potential gender differences in proxy reliance and adherence among our sample would provide further insight into the concerns of greater non-adherence among females. Finally, study adherer-dropout differences on baseline characteristics were explored for the entire sample to determine if characteristics upon entering CR were associated with study participation.

These purposes were pursued as part of a larger study on CR participants funded by a grant from the Royal University Hospital Foundation. The amount of funding limited how long individual participants could be followed after completing CR. The period of one-month was

selected as a reasonable duration to observe whether declines occurred in variables associated with the primary purposes of the study. Furthermore, previous studies investigating reliance on a proxy have found that declines in self-efficacy occur in the later stages of CR when individuals anticipate having to independently self-regulate after the CR program (Bray et al., 2006).

Hypotheses

Theory and the foregoing empirical evidence were the basis for the hypotheses concerning social-cognitive and behavioural variables. Based upon Bandura's ideas about reliance on the proxy (helping agent), participants who report high proxy reliance at late-CR were expected to report significant changes between late-CR and one-month post-CR. Declines were expected for various forms of self-regulatory efficacy (SRE) (a) SRE for exercise scheduling and planning [SRE-SP], (b) SRE for SM-exercise options (SRE-SMO), (c) SM-exercise volume (SM-exercise volume), and (d) persistence. Increased exercise difficulty was also expected as difficulty is one of the constructs discussed in relation to self-efficacy in the agency component of proxy agency.

The hypotheses for examining the between-subject differences between high and low proxy reliant individuals were based upon findings drawn from healthy exercising individuals examined by Shields and Brawley (2004) and from a previous CR proxy efficacy study by Bray and colleagues (2006). Both individuals high and low in proxy reliance were expected to decline in their social-cognitive and behavioural variables (Shields & Brawley, 2004). However, those who are more reliant on the proxy were expected to exhibit a greater decline (i.e., weaker SRE-SP, greater exercise difficulty, and lower persistence) than their less proxy-reliant counterparts.

Gender differences in proxy reliance have not been previously explored. Thus, *exploratory hypotheses* are based on the proxy agency aspect of SCT and current evidence of gender differences in CR adherence (Oosenbrug et al., 2016). The level of proxy reliance was hypothesized to differ between males and females at baseline, based on Bandura's (1997) findings of differences in relinquishing control between men and women. Additionally, based upon findings in the previously mentioned meta-analysis, baseline characteristics were expected to differ among males and females as observed in previous research (e.g., comorbidities, age, anxiety, depression; Oosenbrug et al., 2016).

Finally, no hypothesis was made for study adherer-dropout differences as they were explored to determine if selective differences were observed or if selectivity was not evident on the basis of characteristics examined.

Methods

Participants and Design

Upon receiving ethical approval from the University of Saskatchewan Research Ethics Board (Beh #14-177), researchers met with LiveWell Cardiac Rehabilitation Program (LWCP) staff at two sites in the Saskatoon Health Region to discuss study protocol, participant profiles and inclusion criteria for recruitment. The study design was prospective observational. No physical or psychological risks were expected due to study participation.

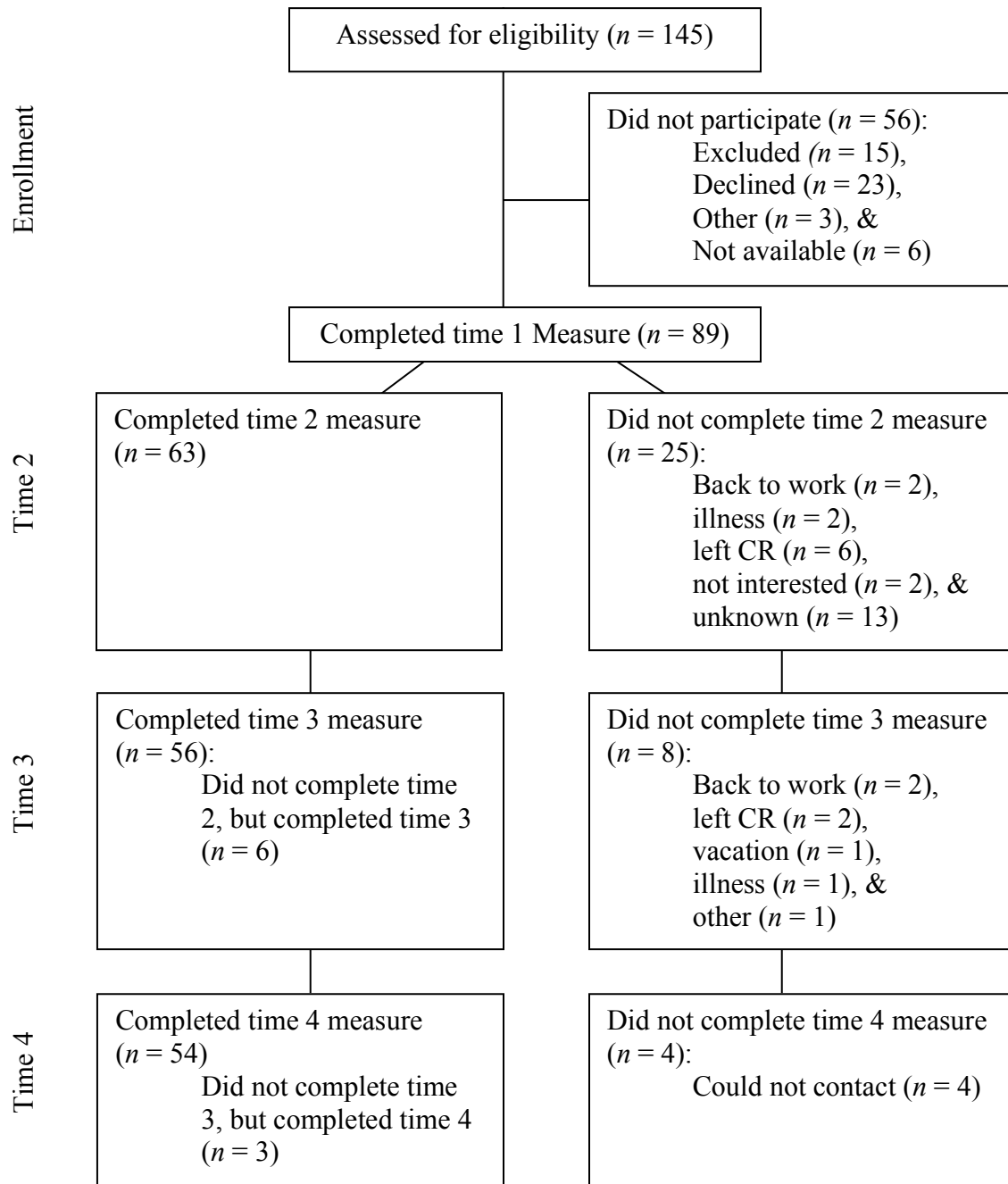
Participants were recruited if they were in the initial 2-weeks of their CR program and had no recent experience participating in CR. Participants were individuals with cardiovascular risk and those who experienced a cardiovascular event (e.g., myocardial infarction). Each participant was followed over the 12-weeks of the program plus one-month after CR in order to

examine participant reactions to self-management of exercise. Assessment time points and variables measured will be outlined in the measures and protocol section that follows.

Recruitment. Fifty-six participants who were contacted declined to participate. Recruitment occurred over the course of two years as study enrolment had to occur in conjunction with each participant's start in the CR program and completion of the 3 months of CR. The majority of recruitment occurred during the fall, winter, and spring seasons. The summer season is the most variable relative to CR enrollment and attendance in the CR programs studied. Thus, no recruitment occurred during that time. Refer to Figure 1 for a diagram of participant recruitment and attrition.

Over the course of two years, 89 individuals participated; 37 (41%) were lost due to attrition at some point during the study. The majority of these participants were also dropouts of the CR program. Attrition from the study is similar to other CR dropout rates reported in the literature and range from 24-50% (Turk-Adawi et al., 2013). Efforts were made to retain participants at each assessment point and if needed, to determine their reason for leaving the study (i.e., illness, back to work, etc.).

Figure 1. Participant Recruitment and Attrition Throughout the Study



Note. Recruitment: Concerns either declining study participation or enrollment. Attrition: As time in study progressed, fewer participants were lost in the study.

As a result of recruitment occurring at two sites in the Saskatoon health region, participants from each site were examined and compared to determine if any differences were present between participants at the two sites. Both CR program sites are run in similar fashion as they have the same LWCP manager and have common staff. Upon entry into the study, recruitment was almost evenly split between the two sites ($n = 49$ Site A, $n = 40$ Site B). No differences were found in baseline health and demographics between the two sites. The final sample of cardiac initiates was male (67.4%) and female (32.6%) with a mean age of 64.5 years. Participants receiving a stent prior to CR comprised 50.6% of the sample followed by bypass surgery and angioplasty/angiogram (27%). The average number of comorbidities reported was 2 (ranging from 0-7). Health-related problems other than those related to heart disease were reported by 58.5% of participants (e.g., arthritis, diabetes, etc.). The most frequently listed health-related problem was high blood pressure (52.8%), followed by high cholesterol (47.2%), and arthritis (33.7%). Refer to Appendix D for a list of participant characteristics at CR entry.

Relative to non-medical demographics, 77.5% of participants were married. The majority were retired (57.3%), while 27% were still employed. The prevalence of CVD varied across age groups; 59.6% were past smokers, and 34.8% claimed they were non-smokers. According to current Centers for Disease Control and Prevention (CDC) norms, the sample was overweight with an average BMI of 29.42 (kg/m^2 ; CDC, 2015).

A recent systematic review and meta-analysis looked to examine gender differences in enrolment to CR over the past decade (Samayoa et al., 2014). On average, 45% of men and 38.5% of women enroll in CR. In a pooled analysis, men were more likely to be enrolled in CR, with women being 36% less likely to enroll in CR. The proportion of males and females in the present study shared similar enrolment rates as reported in Samayoa et al (2014). Both genders

also reported similar characteristics of previous study samples that were predominantly married, retired, overweight, and past smokers. Table 2 highlights the characteristics of both males and females.

Table 1

Male and Female Characteristics of the Sample at CR Entry

Characteristic	Male ($n = 60$)	Female ($n = 29$)
Age (yrs)	64.18, $SD = 9.71$	65.85, $SD = 8.46$
BMI (kg/m^2)	29.42, $SD = 6.62$	29.41, $SD = 6.53$
Number of Comorbidities	1.79, $SD = 1.55$	2.10, $SD = 1.58$
Marital Status		
Married	80%	72.4%
Employment Status		
Retired	58.3%	55.2%
Employed	30%	20.7%
Smoking Status		
Past Smoker	63.3%	51.7%
Never Smoked	31.7%	41.4%
Dropped Out of Study	22	13

Measures

All measures in the study have been used in previous research with either CR or asymptomatic participants. All of the original measures are both valid and reliable, and have been approved by University research ethics boards. Refer to Appendix B for all measures and Appendix C for all internal consistencies of the main measures. The time points of the measures can be found in Table 2. Measures used in the study were as follows:

Proxy reliance (Bray, Brawley & Millen, 2006; Shields & Brawley, 2007): Four items were used to assess how confident participants were in their CR staff to manage their exercise over a 4-week period. Items were assessed using a confidence scale ranging from 0 percent (*not at all confident*) to 100 percent (*completely confident*). This measure was part of a larger instructor responsibility measure and was broken down into the measure of proxy reliance that involved items 1, 3, 4, and 7. These items involved questions regarding time management of exercise sessions, selection of exercises for participants, determining the difficulty of the exercise sessions, and establishing the exercise goals for the sessions. A sample item was “How much responsibility do you feel *the exercise instructor has* in managing the way time is used in the session?” The mean of the four items was used to calculate participants overall level of proxy reliance, with a higher score indicative of greater reliance on the proxy. In the present study, the measure was internally reliable as illustrated by a Cronbach’s alpha of .95. All original 8-items were reported in the measure of instructor responsibility, however only the 4-items mentioned were used in the analyses of proxy reliance and are bolded in the Appendix.

SRE for exercise scheduling and planning (SRE-SP; Glazebrook & Brawley, 2011; McAuley & Mihalko, 1998; Shields & Brawley, 2007; Woodgate & Brawley, 2008): This 8-item measure was used to assess participants’ confidence to manage behaviours necessary to self-regulate exercise on their own over the subsequent 4-weeks, such as scheduling exercise and planning exercise sessions. An example item is, “Over the next 4 weeks, how confident are you that you can arrange your weekly schedule in order to do your exercise no matter what?” Items were assessed using a confidence scale ranging from 0 percent (*not at all confident*) to 100 percent (*completely confident*), with the mean of the 8-items used for analyses. A higher score

was indicative of greater confidence for exercise. Reports of the scale internal consistency ranged from .84 to .93 in previous research and in the present study range from .85 to .96.

Anticipated persistence (Jung & Brawley, 2011): The 4-item measure asked participants how much time, effort, persistence, and attention they were willing to put forth in order to maintain their current volume of CR exercise without the help of program staff over the subsequent 4-weeks. Responses were rated on a 1 (e.g., *little or no time*) to 9 (e.g., *as much time as it takes*) scale, with endpoints correspondent to the aspect of persistence being measured (e.g., *little or no time to as much as it takes, little or no effort to as much effort as it takes*). Participants average score across the four items was used for the persistence score. A higher score was indicative of greater persistence. An example item was, “How willing are you to persist with maintaining your current volume of CR exercise over the next 4-weeks?” Internal consistencies in the present study range from .91 to .96. In previous research the scale has shown to be reliable (Cronbach’s alpha = .92; Jung & Brawley, 2001; Tabachnick & Fidell, 2001).

Volume of exercise (modified Godin Leisure Time Exercise Questionnaire; Godin & Sheppard, 1985): This self-report measure was a modification of the original Godin measure. The modification focused on the assessment of the frequency and volume of moderate and vigorous exercise that was done for at least 20 minutes per session during a typical week for both CR- and SM-exercise. Definitions of both moderate and vigorous exercise were provided to participants. Participants were instructed to only report planned bouts that lasted a minimum of 20 minutes. The instructions given to participants about their recall was based upon a three-fold rationale that took into account: (a) the self-regulation of planned bouts of exercise (i.e., requiring conscious efforts to plan, schedule, and carry out); (b) that planned exercise bouts of longer duration are more apt to be recalled and self-reported with accuracy compared to short

bouts of unplanned exercise (Cust et al., 2008); and (c) stronger associations between self-reported MVPA and objective measures (Matthews et al., 2005). The number of bouts participants reported was used for the analyses of the number of bouts as one behavioural variable. The volume of exercise participants reported was a second behavioural variable. Exercise volume was calculated by multiplying participants' number of weekly bouts by the average minutes of a bout in a typical exercise session they reported. The result was the average volume of exercise (in minutes) per week. The volume of exercise has been used extensively in previous exercise research (e.g., Courneya & Hellsten, 1998; Jung, Bray, & Martin-Ginis, 2008; Motl, McAuley, & DiStefano, 2005).

Perceived exercise difficulty (Jung & Brawley, 2013): Participants' perceived difficulty to carry out exercise and maintain exercise on their own over the subsequent 4-weeks was measured using one-item, "How difficult do you believe it would be to maintain your current exercise frequency on your own over the next 4 weeks?" The response scale ranged from 1 (*not at all difficult*) to 10 (*extremely difficult*), with a higher score indicative of participants perceiving future exercise as being more difficult. Although one-item measures have been criticized due to lack of variability and are more likely to have measurement error, this measure has been used in previous literature with success in providing ranges of exercise difficulty (Jung & Brawley, 2013).

Number of SM-exercise options post-CR and SRE for SM-exercise options (SRE-SMO; Shields & Brawley, 2007): Participants were asked to list up to 15 behavioral options/solutions to being active on their own without the help of CR staff following CR completion. The number of options for self-managed exercise that participants reported was totaled. Participants were also asked about their level of confidence (SRE) for each of the options

they wrote down. Participants SRE-SMO were assessed using an 11-point Likert scale from 0 percent (*not at all confident*) to 100 percent (*completely confident*), with the average of participants top two exercise options used as their SRE for SM-exercise options (SRE-SMO). Only the top two exercise options were analyzed because the order in which the exercise options were reported was considered to reflect their relative salience for exercising (Gierc, Locke, Jung, & Brawley, 2016).

The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983): A 14-item measure asked participants to check one of 4 possible responses that they felt described them the most. An example item is, “I can laugh and see the funny side of things”. Questions alternated, with seven of the questions reflecting a measure of anxiety, while the other seven reflected a measure of depression. Questions that reflected a positive demeanor were scored from 0-3 (e.g., “I look forward with enjoyment to things”), while questions that reflected an anxious or depressive demeanor were scored 3-0 (e.g., “worrying thoughts go through my mind”). The subscales of the HADS measure, anxiety and depression, were scored and analyzed separately. If a participant scored less than 7 on either of the sub-scales, they were indicative of non-problematic anxiety and depression. A score of 8-10 indicated mild, 11-14 moderate, and 15-21 severe anxiety and/or depression. The HADS measure is used for initial diagnosis of anxiety and/or depression as well as to track progress during the CR program. The measure has been validated in many languages, countries and settings including general practice and community settings (Snaith, 2003; Stern, 2014). In the present study, the internal consistency of the anxiety subscale ranged from Cronbach alpha .78 to .80, and the depression subscale ranged from Cronbach alpha .74 to .79.

Table 2

Prospective Design Assessment Timeline

Time Point	Measures
Time 1 (Baseline; 2-weeks after CR program started)	Consent and Demographics Proxy reliance Self-regulatory efficacy for exercise scheduling and planning (SRE-SP) Volume of exercise (CR) Volume of exercise (SM-exercise volume) Anxiety and Depression (HADS) Perceived exercise difficulty Anticipated persistence
Time 2 (2-weeks Prior to CR Graduation)	Same measures as survey #1 excluding consent and demographics. # of SM-exercise options post-CR SRE for SM-exercise options (SRE-SMO)
Time 3 (2-weeks Post-CR)	SRE-SP Volume of exercise (CR) Volume of exercise (SM-exercise volume) Perceived exercise difficulty Anticipated persistence # of SM-exercise options post-CR SRE-SMO
Time 4 (4-weeks Post-CR)	The same measures used in survey #3

Study Protocol

Participants were new CR initiates (i.e., within their first 2-weeks of CR) at one of two LiveWell Cardiac Rehabilitation Program (LWCP) sites, who were at risk or who had experienced a cardiac event as determined by physicians and who were recommended for participation in CR. Program staff assisted researchers by identifying cardiac initiates who recently started the CR program. Following a conversation with a researcher, cardiac initiates had the opportunity to decide whether or not to participate in the prospective, observational study. Interested individuals took home the baseline survey package, and upon written consent,

participants were followed from CR onset, over the 12-week CR program, through to one-month post-CR.

Data were collected via written assessments completed by participants at four time points: (1) baseline/program entry (T1; 2-weeks after initiation); (2) 2-weeks prior to CR completion (T2); (3) 2-weeks post-CR (T3); and (4) 4-weeks post-CR (T4). For each of the later time points, participants received a phone call or email by a researcher asking them if they would be exercising at their LWCP Centre sometime that week. Arrangements were made for the participant and researcher to meet to allow the participant to take home the assessment for completion and return the assessment to the LWCP site. This process insured privacy, allowed for thought, and avoided rushed responses. If the participant was no longer attending CR (i.e., post-CR time points, back to work) or could not make it to the program for that week, alternate arrangements were made. Alternate arrangements provided participants opportunity to answer via Fluid Surveys ©, after receiving an email with their participant ID and a link to the online assessment.

Analytical Plan

Data Screening and Cleaning

SPSS 24 was used for the data analyses. Data were screened for missing values in accordance with recommendations by Tabachnick and Fidell (2013). For example, participants' missing a response(s) to an item(s) on a measure had their mean score for that measure inserted for the missing item, therefore ensuring the most representative value of each participants' response to that scale. If a participant was missing an entire measure, the group's mean was used for a participant's missing measure.

Data were also screened for outliers and normality, with appropriate transformations conducted as needed (Tabachnick and Fidell, 2013). All assumptions regarding the conduct of a within-subjects paired *t*-test, MANOVA, and factorial ANOVA were also checked.

Systematic problems in reporting MVPA by some participants led to large variability and skewness. As a result, the MVPA data were cleaned using procedures recommended by Tabachnick and Fidell (2013) and rules developed and agreed upon by the researchers. Rules were developed for consistency both among and within study participants using a conservative approach. Examination of the MVPA data for purposes of cleaning proceeded using the following steps: 1) the number of CR bouts and minutes reported were verified by using participant attendance logs at their LWCP site, 2) participants' number of CR bouts were checked and compared with their number of SM bouts to ensure there was no double reporting of exercise bouts per week, and 3) if a participant totaled their weekly bouts of exercise minutes instead of reporting their average length of a typical bout, this value was divided by their number of reported bouts to get their average length of a typical bout. All of these steps were taken to improve clarity and conservative accuracy.

Assessments at time 3 (T3) were part of a larger funded examination of CR participants in the region and were not relevant to the present study hypotheses concerning proxy reliance. Significant declines in any of the primary variables were not expected in close proximity to completion of the CR program, and thus T3 was not a focus of the present study.

Analyses

Dependent variables were partitioned into groupings based on their theoretical and descriptive similarities. There were 4 overall categories of groups, a) demographics, b) health, c) social-cognitive, and d) behavioural. Demographics included variables such as marital status,

employment status and age. The health category involved participants' total number of comorbidities, anxiety and depression (HADS), their BMI, and their smoking status. The social-cognitive group included the variables of SRE-SP, SRE-SMO, exercise difficulty, and persistence. Lastly, the behavioural grouping consolidated the variables of MVPA (SM and CR) number of bouts and volume of exercise, and the number of SM-exercise options. Together, these concerned what people do while in CR and post-CR for their SM-exercise.

Given the small sample with the number of dependent variables being examined, it seemed prudent to partition the variables into the above categories to help preserve power (i.e., subject to dependent variable ratio) in the different analyses used to examine each of the study purposes. Additionally, Field (2013) suggests that in situations in which there is a good theoretical basis for including some but not all of the dependent variables, separate analyses should be conducted. Theoretically and practically, one large MANOVA with all variables may overlook interesting effects early in the research when an omnibus test is non-significant (Bock, 1975). Additionally, where results were not significant at the $p < .05$ level, but were at the $p < .10$ level, they were reported as *trends*. All other results were considered non-significant.

Descriptive statistics, means and standard deviations, of the study variables were calculated in order to describe the data for all variables. The primary and secondary study purposes and exploratory analyses were investigated using within-subjects paired *t*-test's, MANOVA's, factorial ANOVA's, and chi-square tests as appropriate for the data used to answer research questions associated with the purposes.

Proxy reliance differences. Within-subjects paired *t*-test's were used to examine purpose 1 regarding differences over time in social-cognitive and behavioural variables in

individuals who were high in proxy reliance. All paired *t*-test's were separated into social-cognitive and behavioural variables in order to preserve power.

MANOVA was used to examine the additional primary purpose of comparing participants' high and low in proxy reliance with respect to social-cognitive and behavioural variables. A median split was used to categorize individuals into proxy reliance groups (i.e., higher or lower in proxy reliance) at baseline and at time 2.

The proxy reliance groups categorized at both baseline and T2 were significantly different. Proxy reliance group means at baseline were as follows: low proxy reliance $M = 38.74$, $SD = 19.23$ ($n = 45$), while the high proxy reliance group mean was $M = 83.53$, $SD = 11.49$ ($n = 44$). The proxy reliance groups at T2 were as follows: low proxy reliance group mean was $M = 32.27$, $SD = 15.4$ ($n = 27$), while the high proxy reliance group mean was $M = 77.85$, $SD = 10.16$ ($n = 36$). The two groups were empirically different at both baseline and T2. Therefore, analyses using the median split categorization proceeded.

Gender differences. The secondary purpose of exploring gender differences resulted in a series of analyses. A MANOVA and chi-square test were used to investigate gender differences in baseline characteristics based on health (e.g., number of comorbidities, BMI) or age demographics. Chi-square was used for the categorical variables (e.g., marital, employment, and smoking status).

Gender differences in late-CR proxy reliance were also explored using a 2×2 factorial MANOVA procedure. The factors were T2 proxy reliance (high and low) and gender (male and female). Finally, gender differences were further explored in terms of adherence to CR. For this exploratory analysis, a 2×2 factorial MANOVA was utilized. The factors were study adherence

classification (study adherer and dropout) and gender (male and female). Both MANOVA's used multiple dependent variables divided into social-cognitive and behavioural groupings.

Not surprisingly, all factorial MANOVA analyses mentioned above involved unequal numbers of participants in each cell of the design. Thus, to control for this imbalance and correlation between factors, SPSS used type III sums of squares to adjust the analysis such that estimates of variable means being compared were more precise.

Adherer versus non-adherer differences. Factors related to adherence were investigated to examine baseline characteristics that could be correlates of adherence or non-adherence to CR (e.g., SRE-SP, anxiety, number of comorbidities). For example, Bandura (1997, p. 411) has stated that among the individuals who try to exercise regularly, those of weaker efficacy become poor adherers. These analyses were conducted using MANOVA and chi-square tests as appropriate.

For the purpose of this study, an adherer was defined as any participant who remained in the CR program for the entire 12 weeks, regardless of their post-CR participation. Dropouts were characterized as those who left CR before their graduation date and thus did not complete the full 12 weeks of CR. Individuals who withdrew their participation from the study before T2 but continued to attend CR were classified as adherers. All dropouts were contacted to determine their reason for leaving to accurately classify adherers and dropouts. Consistent with previous reports of dropout rates (24-50%), the study dropout rate was 25% (Turk-Adawi et al., 2013).

All exploratory analyses first considered potential differences among the theoretically driven variables and second, with variables that have been investigated in previous literature.

Non-significant effects that were near the critical .05 alpha level were considered to be *trends* and were reported as such.

Results

High Proxy Reliance

Proxy reliance at baseline. To examine the first hypothesis regarding high proxy reliance and declines in social cognitions and behavior post-CR, a within-subjects paired *t*-test was used (i.e., the proxy reliance groups were formed through a median split). The proxy reliance groupings were used to examine declines from T2 and one-month post-CR (i.e., the last within CR assessment (T2) to one-month post-CR (T4) for the high proxy reliance group). Significant differences were found for both social-cognitive and behavioural variables. Individuals high in baseline proxy reliance had a significant decline in persistence, $t(1, 22) = 3.08, p = .006$, between time 2 [T2] and time 4 [T4] with a medium to large effect size, Cohen's $d = 0.68$. A significant difference was also found for the number of SM-exercise options from T2 to T4 with $t(1, 20) = 2.98, p = .007$, Cohen's $d = 0.88$. As well, there was a *trend* and small to medium effect size in the predicted direction for SRE-SP decline from T2 to T4 $t(1, 24) = 1.91, p = .068$, Cohen's $d = .42$. The decline in persistence and SRE-SP were as hypothesized for high proxy reliance. See Table 3 for means (*M*) and standard deviations (*SD*).

Table 3

Individuals with High Proxy Reliance at Baseline: Responses to Self-management

	Time 2		Time 4	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Social-Cognitive				
SRE-SP	83.7	14.64	75.6	23.03
Persistence*	8.38	.74	7.59	1.46
SRE-SMO	87.50	14.34	85.36	16.95
Exercise difficulty	3.64	2.59	4.5	2.81
Behavioural				
Number of SM-exercise options*	3.71	1.98	2.43	2.09
SM-exercise volume (min.)	79.77	93.58	60.45	52.6

Note. At T2, high proxy $n = 31$. At T4 high proxy $n = 23$. SRE-SP and SRE-SMO were measured on a 0% (*not at all confident*) to 100% (*completely confident*) scale. Persistence was measured on a 1 (*little or no time*) to 9 (*as much time as it takes*) scale. Exercise difficulty was measured on a 1 (*not at all difficult*) to 9 (*extremely difficult*) scale. SM-exercise volume was calculated by multiplying the number of bouts reported by the average minutes of a typical bout to get participants total volume of exercise (in minutes) per week. The number of SM-exercise options participants reported was used in analyses.

*Significant at the .05 level.

A trend (not significant but $p < .10$) was observed in SRE-SP.

Proxy reliance after 10-weeks of CR experience. Individuals reporting high proxy reliance at 2-weeks pre-CR graduation (time 2) were found to have a significant difference in their level of persistence from T2 to T4, $t(1, 23) = 2.33, p = .029$, Cohen's $d = .58$. A significant difference was also found in the number of SM-exercise options from T2 to T4, $t(1, 21) = 2.35, p = .029$, Cohen's $d = .44$. Both persistence and the number of SM-exercise options illustrated a decline from T2 to T4 among those individuals reporting high reliance on the proxy. Volume of

SM-exercise per week from T2 to T4 was in the expected direction for the individuals with high reliance on the proxy, at $p = .09$, Cohen's $d = .39$, and thus was a trend. Mean scores for the study variables can be found in Table 4.

Both baseline and T2 individuals with high proxy reliance had consistent significant results of a decline in persistence and the number of SM-exercise options from T2 to T4. Regardless of the time when proxy categorization was used (i.e., Assessment 1 or Assessment 2) results were in the expected direction of a decline post-CR.

Table 4

Time 2 High Proxy Reliance: Responses to Self-management

	Time 2		Time 4	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Social-Cognitive				
SRE-SP	81.45	18.29	76.97	20.94
Persistence*	8.21	.917	7.48	1.55
SRE-SMO	82.86	15.12	86.78	14.65
Exercise difficulty	4.04	2.93	4.48	2.78
Behavioural				
Number of SM-exercise options*	3.59	2.46	2.5	2.42
SM-exercise volume (min.)	90.23	98.64	58.64	52.58

Note. At T2, high proxy $n = 31$. At T4 high proxy $n = 23$. SRE-SP and SRE-SMO were measured on a 0% (*not at all confident*) to 100% (*completely confident*) scale. Persistence was measured on a 1 (*little or no time*) to 9 (*as much time as it takes*) scale. Exercise difficulty was measured on a 1 (*not at all difficult*) to 10 (*extremely difficult*) scale. SM-exercise volume was calculated by multiplying the number of bouts reported by the average minutes of a typical bout to get participants total volume of exercise (in minutes) per week. The number of SM-exercise options was examined using the number of SM-exercise options participants reported.

*Significant at the $p < .05$ level.

A trend (not significant but $p < .10$) was observed in SM-exercise volume.

High versus Low Proxy Reliance

Proxy group comparisons at baseline. MANOVA's were run to compare individuals high and low in proxy reliance at baseline for both social-cognitive and behavioural variables. No significant differences were found between baseline high and low proxy reliant individuals on the social-cognitive variables at any of the time points.

MANOVA's run for the behavioural variables showed no significance in the multivariate tests. Furthermore, when examining the univariate analyses no significant differences were found between individuals reporting high or low proxy reliance.

Proxy group comparisons after 10-weeks of CR experience. Proxy group status changed between baseline and T2 for 19 of the 64 individuals who remained in the study. Specifically, a change from status of low proxy to high proxy reliance was observed in 12 participants, while 7 participants changed from the status of high proxy to low proxy. Given this change, MANOVA's were conducted using T2 proxy reliance categorization of high/low proxy to examine the comparison between groups on variables relevant to self-management.

MANOVA's comparing high and low proxy groups did not reveal significant differences for social cognitive variables or behavioural variables at T2. However, to avoid overlooking important findings versus completely discarding interesting results due to an omnibus test, ANOVA's were conducted. Regardless, there were few interesting differences.

For the behavioural category at T2, examination of the univariate tests revealed a significant difference between high and low proxy reliant individuals *for the number of CR bouts*, $F(1, 54) = 4.17, p = .046$, Cohen's $d = .55$. Low proxy reliant individuals reported a mean of 2.88 CR bouts, $SD = 1.05$, while high proxy reliant individuals reported 3.42 CR bouts, $SD = .92$.

To examine whether participants were replacing CR exercise with SM-exercise, the volume of those types of exercise was examined. High proxy CR-exercise volume was ($M = 154, SD = 72.7$), while the low proxy CR-exercise volume was ($M = 147.8, SD = 76$). In addition, participants were also engaged in a small amount of SM-exercise volume. The high proxy group completed ($M = 82.4, SD = 93$), compared to the low proxy group ($M = 91, SD = 81$). The groups

were not significantly different for either type of exercise. Participants in both groups did not seem to be replacing CR-exercise with SM-exercise. These means and standard deviations can also be found in Appendix E.

Given that selectivity of the sample caused by study attrition could cause regression to the mean and thus contribute to artifacts in the data, comparisons of proxy reliance groups at T4 were conducted by controlling for the value of the same variable at T3. In other words, the T3 variable was used as a covariate in the analysis via an ANCOVA procedure (Campbell & Kenny, 2003). At T4, a significant difference in SM-exercise volume was found, $F(1, 37) = 4.532, p = .04$, Cohen's $d = .67$. Low proxy individuals reported double the amount of SM-exercise volume per week ($M = 119.5, SD = 116.7$) compared to individuals reporting high proxy reliance ($M = 59.5, SD = 51.1$). All other means and standard deviations not significant can be found in a table in Appendix E.

Gender Differences

Baseline demographic and health variables. Mean scores and standard deviations are reported in Table 5. A MANOVA revealed a *trend* for variables in the category of health ($p = .08, \eta_p^2 = .08$). When examining the separate univariate tests, the number of comorbidities reported between males and females was significantly different, $F(1, 84) = 7.05, p = .009$, Cohen's $d = .62$.

A chi-square analysis revealed no gender-related association on the variables of marital status, employment status, or smoking.

In analyzing gender differences in anxiety and depression subscales of the HADS, a MANOVA revealed a *trend* (Wilks' lambda $p = .07, \eta_p^2 = .06$). Further univariate tests revealed

a significant difference between gender for the anxiety subscale, $F(1, 87) = 5.53, p = .021$, Cohen's $d = .53$. Women reported having greater anxiety than their male counterparts at the time of program initiation. The mean for the HADS depression subscale also followed this pattern but was not significant.

Table 5

Baseline Demographic and Health Differences between Males and Females

Variable	Males		Females	
	<i>M/Count</i>	<i>SD</i>	<i>M/Count</i>	<i>SD</i>
Age (yrs)	64.18	9.71	65.85	8.46
Marital Status				
Married	48	-	21	-
Other	12		8	
Employment Status				
Retired	37	-	20	-
Employed	23		9	
Number of Comorbidities**	1.79	1.55	2.74	1.48
BMI (kg/m ²)	29.43	6.54	29.41	6.6
Smoking Status				
Never Smoked	19		12	
Past Smoker	38	-	15	-
Current Smoker	3		2	
Anxiety*	5.08	2.85	6.74	3.61
Depression	3.00	2.50	3.96	3.24

Note. Marital status, employment status, and smoking status were all analyzed using a chi-square test. All other variables were analyzed using a MANOVA. Males $n = 60$, females $n = 29$. The total number of comorbidities = number of health-related problems checked. BMI was calculated using participants' height and weight.

* Significant at the $p < .05$ level; ** Significant at the $p < .01$ level.

Baseline social-cognitive differences. Means and standard deviations are reported in Table 6. The social-cognitive MANOVA indicated a *trend* ($p = .07$, effect size $\eta_p^2 = .08$) at baseline, but only the univariate test for baseline SRE-SP revealed a significant difference

between males and females, $F(1, 87) = 4.16, p = .04$, Cohen's $d = .46$, with females reporting lower SRE-SP. There was also a significant difference in the expected direction for exercise difficulty, $F(1, 87) = 3.7, p = .05$, Cohen's $d = .44$, with females reporting greater exercise difficulty at the start of the CR program.

Table 6

Baseline Social-cognitive Differences between Males and Females

Variable	Males		Females	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
SRE-SP*	87.36	10.25	82.25	12.64
Exercise Difficulty*	2.87	1.98	3.93	3.16

Note. Males $n = 60$, females $n = 29$. SRE-SP was measured on a 0% (*not at all confident*) to 100% (*completely confident*) scale. Exercise difficulty was measured on a 1 (*not at all difficult*) to 10 (*extremely difficult*) scale.

*Significant at the $p < .05$ level.

Time 4 social-cognitive differences. Means and standard deviations are reported in Table 7. Gender differences in the social-cognitive variables were also examined at 1-month post-CR (T4) for individuals remaining in the study. A univariate ANOVA revealed a significant difference in exercise difficulty between males $F(1, 40) = 6.4, p = .02$, Cohen's $d = .88$. Females perceived exercise to be more difficult than their male counterparts relative to self-managing their own exercise following their CR program.

Time 2 behavioural differences. Means and standard deviations are reported in Table 7. A MANOVA examined gender differences in behavioural variables, specifically, the number of CR- and SM-exercise bouts and the volume of SM-exercise per week as well as for the number of SM-exercise options people listed. A MANOVA revealed a significant difference between

males and females in T2 behavioural variables (Wilks' Lambda), $F(3, 56) = 3.106, p = .034, \eta_p^2 = .143$. Univariate tests of T2 exercise variables, indicated a significant difference for the number of SM-exercise bouts, $F(1, 58) = 4.12, p = .047$, Cohen's $d = .54$. Females reported doing one less SM-bout in a 7-day period than males. The number of SM-exercise options was significant, ($p = .05$, Cohen's $d = .56$). Additionally, SM-exercise volume per week ($p = .06$, Cohen's $d = .54$) revealed a similar *trend* with females reporting fewer minutes per week.

Table 7

Time 4 Social-cognitive and Time 2 Behavioural Differences between Males and Females

Variable	Males		Females	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Social-Cognitive (T4)				
Exercise Difficulty*	2.87	1.98	3.93	3.16
Behavioural (T2)				
Number of SM-exercise bouts*	2.33	1.84	1.33	1.49
Number of SM-exercise options*	3.86	2.51	2.55	1.82
SM-exercise volume (min.)	103.45	97.17	54.44	71.8

Note. At T2, males $n = 42$, females $n = 18$. At T4, males $n = 37$, females $n = 15$. Exercise difficulty was measured on a 1 (*not at all difficult*) to 10 (*extremely difficult*) scale. The number of SM-exercise bouts was analysed by using the number of bouts participants reported. SM-exercise volume was calculated by multiplying the number of bouts reported by the average minutes of a typical bout to get participants total volume of exercise (in minutes) per week. The number of SM-exercise options was examined using the number of SM-exercise options participants reported.

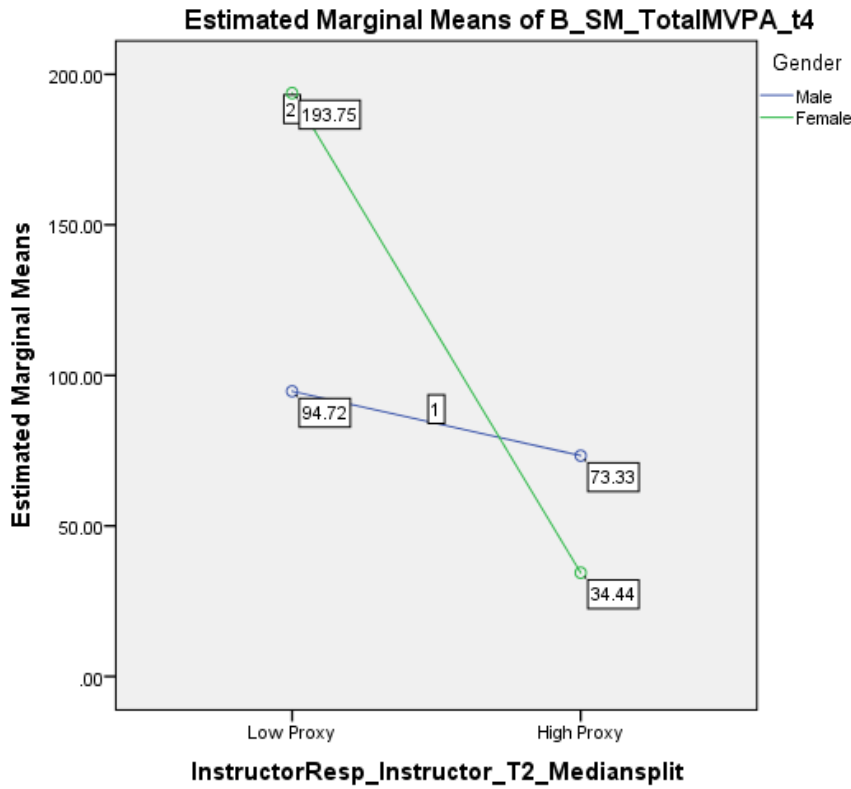
*Significant at the $p < .05$ level.

Gender by proxy reliance comparisons. The decline in social-cognitive and behavioural variables appear to be most evident when the T2 proxy reliance categorization was used (see

earlier results). For this reason, the gender by proxy reliance analyses were only performed using this proxy reliance categorization. A 2 (gender) \times 2 (T2 proxy reliance groups) factorial MANOVA was conducted on each of the groups of social-cognitive and behavioural variables (i.e., social-cognitive variables: $n = 4$; behavioural variables: $n = 3$) at T2 and at T4. The MANOVAs at T2 were non-significant and further follow-up ANOVA analyses were also non-significant.

For the analyses at T4, there were no significant effects for the social-cognitive variables. For the behavioural variables (i.e., # of SM-exercise options, SM-exercise volume, SM-exercise bouts), a significant MANOVA main effect was observed for proxy reliance categorization (Wilks' Lambda) $F(3, 40) = 5.63, p = .003, \eta_p^2 = .30$. Other effects were not significant. Follow-up ANOVA revealed a significant interaction for SM-exercise volume, $F(1, 42) = 5.92, p = .019, \eta_p^2 = .12$. See Figure 2 for a diagram of the interaction. The interaction is created by the difference between the high proxy females and all other participants. No effects were observed for the other behavioural variables. Caution should be reserved for the interpretation of the interaction as the sample sizes and standard errors of each of the 4 groups differ (i.e., high proxy women $n = 9, M = 34.4, SE = 27.2$; low proxy women $n = 4, M = 193.75, SE = 40.8$; high proxy men $n = 15, M = 73.3, SE = 21.06$; low proxy men $n = 18, M = 94.7, SE = 19.23$).

Figure 2. Gender by proxy reliance interaction on the volume of SM-exercise: One-month post-CR



Adherence in CR

MANOVA was used to investigate differences in adherers and dropouts of the CR program utilizing the same categories as in objective 2: demographics, health, social-cognitive, and behavioural. A MANOVA revealed a significant difference between adherers and dropouts in CR for the category of health demographics, (Wilks' Lambda) $F(3, 82) = 4.29, p = .007, \eta_p^2 = .14$. Univariate tests, revealed a significant difference between adherers and dropouts for age, $F(1, 84) = 8.86, p = .004$, Cohen's $d = .80$. Individuals who were younger ($M_{age} = 58.94, SD = 8.35, n = 17$) tended to dropout of CR, while those who were older ($M_{age} = 66.13, SD = 9.05, n = 69$) remained in CR.

Health and demographics were examined using a chi-square test for the variables of marital status, employment, and smoking status. Employment status revealed individuals who dropped out before completion of the CR program were those individuals who were employed (66% of those who dropped out were employed), while the majority of the individuals who maintained participation in the CR program were retired (71.8%), $\chi^2(1) = 9.24, p = .002$. In the chi-square test for baseline variables, 18 participants were classified as dropouts, while 71 were classified as maintainers of the CR program. All other tests were non-significant.

2×2 factorial MANOVA's found no significant interactions for gender and adherence on any of the social-cognitive or behavioural categories. Additionally, an ANOVA run to investigate differences between adherers and dropouts in baseline proxy reliance revealed no significant difference.

Last, because study participants were recruited from two CR sites, analyses were run to determine any potential differences. There were no age, health, or demographic variable differences (i.e., employment status, marital status) at baseline ruling out selectivity arguments based upon those variables. However, a difference was found in baseline perceived exercise difficulty ($p = .01$, Cohen's $d = .56$). At time 2 (T2 – 2 weeks prior to CR completion), differences between the sites were found in SRE-SP ($p = .02$, Cohen's $d = .65$) and participants volume of CR-exercise ($p = .01$, Cohen's $d = .74$).

In terms of adherence to the CR program sessions, no differences were found. However at T2 (2 weeks prior to CR completion), fewer participants were attending CR at both sites. Specifically, $n = 39$ at Site A, and $n = 24$ at Site B as compared to 49 participants at Site A and 40 at Site B at baseline assessment.

Discussion

CR is a well-recognized therapy for individuals who are at risk or have had a cardiovascular event. Not all individuals recommended for CR enroll, but for those that do, the reduction in risk in terms of future re-hospitalization or mortality has been well established.

The Present Study in CR Context

The characteristics of the present study sample are comparable to previous studies (Oosenbrug et al., 2016). An inaugural report on the status of CR in Canada found more than 200 Canadian CR programs provide services to more than 50,000 new patients annually (Grace et al., 2015). Twelve CR programs participated in the analysis of Canadian CR Registry data from 4 provinces. At the time of program admission, patients were on average 66.3 ± 11.5 years old, with males making up 71% of the sample. A majority of the sample identified themselves as “married” (71%) and lived with their spouse. Early termination of CR was most often due to patient dropout (87%), followed by ill-health events or death (13%).

The Canadian CR Registry provides support that the present sample is representative of other CR program participants. High burdens of risk factors (i.e., high BMI, higher anxiety) are also present in CR patients upon program admission and currently represented among the present sample of CR participants.

Ironically, after initial success in CR, a number of individuals tend not to sustain their SM-exercise. A decline in exercise adherence has been evident in individuals 6-months after CR (Moore et al., 1998; Janssen et al., 2014) and in the present study was evident among participants only 1-month after CR. As mentioned earlier, proxy reliance may be one potential reason for the decline in adherence to exercise resulting from the dilemma of over-reliance on CR staff. The problematic consequences of proxy reliance become evident when individuals are faced with the

behavioural challenge of self-managing exercise following CR. Additionally, gender may be a factor (Oosenbrug et al., 2016) that plays a role in adherence to exercise following completion of CR. Gender differences in CR adherence have been well documented.

The current study examined individuals who attended standard-care CR and who differed in the extent to which they relied on their proxy (i.e., CR staff) for guidance in the program. Proxy reliance group differences were investigated in social-cognitive and behavioural variables known to be associated with adherence. Gender-related differences were also investigated relative to the primary measures (e.g., SRE-SP) as well as others reported in the literature (e.g., anxiety).

High Proxy Reliance

The development of personal agency through a proxy occurs when novice exercisers turn to a proxy for assistance in their uptake of a new behaviour (Bandura, 1997). However, when the proxy is no longer available to the individual, the dilemma of too much proxy reliance may be detrimental to future SM-exercise. In the present study, individuals high in proxy reliance declined significantly in their persistence for SM-exercise between 2-weeks pre-CR graduation and 1-month post-CR. Results appear to support Bandura's theorizing regarding the dilemma of proxy reliance and risk to exercise self-management for those who rely more on the proxy. Furthermore, the present findings are similar to those of Shields and Brawley (2007) who examined exercising individuals high and low in preference for a proxy managing their exercise. High preference individuals anticipated being less persistent over time in performing exercise and perceived themselves as less able to adapt to exercise situations requiring independence.

In the present study, a significant difference was also found in the number of SM-exercise options in which individuals with higher proxy reliance would engage in the month after

CR had ended. Specifically, the number of exercise options individuals considered for exercise declined over time. High proxy reliance may remove the need to learn to self-regulate while in the CR program. Thus, these individuals may not consider a variety of exercise opportunities for self-management post-CR. However, this speculation requires future cause-effect testing.

Furthermore, SRE-SP also declined in the predicted direction in the month following CR graduation. This trend parallels previous research by Shields and Brawley (2007; also see Shields, 2005). Results for individuals high in proxy reliance are in line with study hypotheses. Those who rely more on CR staff choose fewer options for SM-exercise and are less persistent when left to manage exercise on their own (1-month post-CR). Self-efficacy has been related to individuals' exercise behaviour (McAuley & Blissmer, 2000; Shields, 2005), and in the current study, to persistence. SRE-SP for exercise and SM-exercise volume were declining among high proxy reliance individuals with small to medium effect sizes ranging from Cohen's $d = .39 - .42$. Although these latter results reflected trends versus significant effects, when all are considered collectively, the pattern of decline is similar. With the steady decline in CR participants' persistence as well as other social-cognitions, one speculation is that participants have not gained essential mastery experience to help develop the necessary confidence in their abilities to persist over time and maintain exercise. Future research should attempt to examine the causal nature of this speculation.

High vs. Low Proxy Reliance

Significant differences were also found between individuals with high and low proxy reliance for SM-exercise volume at 1-month post-CR. Individuals high in proxy reliance reported doing less than half the amount of SM-exercise as those who reported low proxy reliance. Additionally, individuals high in proxy reliance reported fewer options for SM-exercise. This is

similar to research by Shields and Brawley (2007) who found that individuals who preferred high-proxy assistance were less likely to choose exercises that required self-management as an exercise option. Results suggest that self-management of behaviour differs between individuals high or low in proxy reliance and is comparable to previous research.

Although the hypothesis of significant differences between individuals high and low in proxy reliance for the social-cognitive variables was not supported, interesting declines in the hypothesized direction were found. For example, a noticeable decline was found in high and low individuals' SRE-SP and persistence from end of CR to 1-month post-CR.

Considering the results of the study collectively (i.e., significant and non-significant), the effects produced and the direction of means raise the following possibility. Specifically, those who rely more on a proxy may not be gaining the mastery experiences that enhance learning of self-management skills. Lack of the necessary practice for successful self-management may result in unsuccessful experiences (i.e., mastery) which lower related efficacy beliefs (e.g., for SM-exercise; Bandura, 1997). Several studies (e.g., Brawley et al., 2012; Brawley et al., 2014; Rejeski et al., 2003) have shown that when essential mastery experiences are taught and provided during treatment there are adherence benefits post-program. When treatments offer training in self-management skills and related mastery practice compared to treatments without these opportunities (i.e., usual-care), both efficacy and SM-exercise suffer in the usual care treatment groups and are sustained in the enhanced training group.

Overall, results support Bandura's (1997) theorizing as both the pattern of social cognitions and SM-exercise reported by individuals with high reliance on the proxy reflected a potentially greater challenge for them as they transitioned into their self-management of exercise post-CR.

Gender Differences

Gender differences have often been reported in CR populations, but proxy reliance has not been a focus; and is important to consider given the known control differences observed between genders in the CR literature. Accordingly, a difference in proxy reliance between males and females was explored. At both baseline and after 10-weeks of CR experience, females reported greater reliance on CR staff compared to males. Although females' level of proxy reliance increased over the 10-weeks, these results were not significant. Gender differences were however, significant in social-cognitive and behavioural variables, and in all gender analyses, women consistently reported different responses than men. Women reported greater anxiety and lower SRE-SP at baseline than men (effect sizes averaged Cohen's $d = .45$). However, despite these differences, the means would suggest that anxiety was not a concern and women were still quite confident in their ability to exercise at baseline. At one-month post-CR, women reported significantly greater exercise difficulty than men (Cohen's $d = .88$). This finding requires further investigation in order to determine if it is reliable and valid.

In a previous study (Schuster & Waldron, 1991) of gender differences in CR, women were more likely to have lower self-efficacy and exercise tolerance upon program admission than men. Women in the present study reported lower SRE-SP for exercise at the time of program initiation compared to men. Lower SRE for scheduling and planning exercise may be a result of women reporting a greater level of anxiety than males, ultimately affecting their confidence in performing the new behaviour of CR exercise (McGrady et al., 2009).

Additional gender differences emerged in demographic and health variables that are consistent with previous CR findings (Oosenbrug et al., 2016), such as females reporting a greater number of comorbidities and higher anxiety at time of program initiation. However, both

genders' scores on the HADS (Snaith, 2003; Stern, 2014) were not of concern as total scores were less than those identified as clinically problematic.

Fewer women were enrolled in the CR program; however, no significant differences were found in terms of gender and adherence. To put the present result in perspective, previously mentioned CR literature found fewer women enroll in CR (Oosenbrug et al., 2016). Meanwhile, the lack of adherence differences found between men and women may be supported by Oosenbrug et al (2016) who found that gender differences in CR programs start to diverge over time, and significantly in programs longer than 12 weeks' duration. Suggestions to minimize gender differences in CR have led to investigation of effects in women-only programs compared to standard-CR models (i.e., both genders). Women-only programs have shown to be associated with greater improvements in some psychosocial outcomes; however, women have also been shown to achieve the same benefits as men when they participate in mixed-sex CR (Llyod, 2009). Midence et al (2016) conducted a three arm (mixed-sex, women-only, or home-based CR) randomized trial that recruited women from 6 Ontario sites. Overall, adjusted results comparing programs revealed women's outcomes were equivalent regardless of their CR program.

Adherence in CR

Proxy reliance was examined for adherers and dropouts in the current study however, no differences were found. This was explored because CR adherence of individuals higher in proxy reliance would be more likely to suffer (cf., Bandura, 1997; Shields, 2005), as high proxy reliance limits the development of confidence in the use of self-regulatory skills, threatening adherence (Shields, 2005). CR dropouts most often have low efficacy for motivating themselves to exercise (Bandura, 1997), with previous research showing that individuals who possess high self-efficacy beliefs, are more likely to adhere to exercise-based CR programs (Daly et al., 2002).

Although the current study did not find any differences or *trends* in SRE-SP between adherers and dropouts, the direction of the means was as expected. Those who dropped out of CR had lower SRE for scheduling and planning exercise compared to adherers. Future studies should continue to examine for the possibility of differences to determine the reliability of this finding.

Relevance of Findings

The current study directly addresses one of the suspected determinants of the exercise decline that follows CR participants' over-reliance on CR proxies. It is critical to understand the changes that are necessary in order to improve the delivery of CR exercise programs and have patients self-manage and sustain their level of exercise.

Findings from the present study are both similar to and different from past literature on proxy reliance. The examination of proxy reliance over time and the differences in high and low proxy reliance in a CR sample fills gaps in the literature. Additionally, the examination of gender differences in proxy reliance was new.

Both CR staff and patients can benefit from countering the proxy reliance dilemma. Building a collaborative relationship between CR staff and participants may help participants to perceive greater ownership over their SM-exercise (cf., Gierc, Brawley & Rejeski, 2016). Additionally, if proxies were to increase participants' opportunities to practice self-management in preparation for transitioning from supervised CR to SM-exercise post-CR, the benefits would not only be for adherence but also in sustaining health outcomes (e.g., functional capacity; cf., Brawley et al, 2016).

These additions to the literature are important for advancing knowledge on the proxy reliance dilemma and understanding changes necessary to improve CR staff delivery of exercise-based therapy. Overall, benefits lie in (a) countering the proxy over-reliance dilemma, and (b)

identifying differences between high and low proxy reliant individuals as well as genders in order to focus tailored efforts towards those with the greatest risks relative to proxy reliance.

Strengths

In following CR participants over time several changes were examined that are not characteristic of previous cross-sectional research. Examination of proxy reliance at baseline and end of CR and social-cognitive and behavioural variables across the CR program and beyond was new. Additionally, using theory to guide the study and the primary hypothesis was a strength as was the use of previous literature to guide the secondary hypotheses and exploratory objectives.

Limitations

A possible study caveat was the division of participants into high and low proxy reliance groups using the median split. In dichotomizing proxy reliance, group comparisons are made simpler given categorization into groups of high and low in proxy reliance (Farrington & Loeber, 2000). However, there are liabilities in dichotomizing a continuous variable, such as leading to a false correlation between variables, or causing a loss of effect size and statistical significance (Cohen, 1983). Overall there is a potential threat in using arbitrary cut-points and dichotomizing a variable can risk the loss of important information (Cohen, 1983). For example, does an individual with a score of 49% really differ from a score of 50% proxy reliance? However, for the present study, it is noteworthy that a good percentage of individuals did not change in their proxy reliance group status over time (70% from baseline to 2 weeks before CR completion).

Although the majority of the measures used multi-item scales, the perceived exercise difficulty measure used a one-item scale, which can carry some limitations. One-item scales are more susceptible to different interpretations and meanings ascribed by the participants. However,

the use of the one-item measure is not a major limitation as there was only one present in the study and it was less onerous than some of the multi-item measures.

The selectivity of the sample was another limitation. Individuals had to be novices to the CR program (i.e., started within 2-weeks of initial recruitment) and were conveniently sampled upon program initiation. Additionally, as time went on in the study, the sample became more selective with the occurrence of study attrition. The sample of individuals who dropped out of CR were significantly younger and employed (66%), resulting in a more selective and smaller sample for detecting group differences. The majority of individuals who dropped out of the study, also dropped out of CR and thus examination of study and CR dropouts were not independent.

New Directions

Limitations offer thoughts on future research possibilities. General improvements to the present study would be to obtain a larger sample and use the proxy reliance data in a more continuous fashion (i.e., relationships between strength of reliance and adherence). However, this would still not prevent selectivity of the sample. To reduce this, for example, randomization of proxy reliance individuals to different CR treatments would be needed. Additionally, following individuals over a longer period of time (6-months post-CR) would provide further insight into adherence and the longer term relation of over-reliance on exercise self-management. For example, if participants continue to be followed for periods longer than 1-month, would the decline in SM-exercise volume and SRE-SP observed in the present study continue to decline 6-months after- as observed in previous studies? One-month post-CR only offers a short-term hint about the impact of high proxy reliance.

Participants in CR programs select and utilize a proxy for a variety of reasons and future studies could examine these reasons. Possible reports of participants' most prominent reason for interaction with CR staff could provide further insight into the proxy reliance dilemma and possibly intervene in future studies. Additionally, this could be done using questions about outcome expectations (cf., Bandura, 1997) to investigate participants' expectations for CR staff performance and responsibility and the relation of those variables to reliance on staff member as a proxy agent.

Beyond these improvements, more innovative future research directions could be some of the following. CR staff must recognize the potential dilemma that can arise when they are employed as proxy agents, particularly at the end of participants' CR program (Bandura, 1997). If the proxy reliance phenomenon in CR proves to be a reliable effect, then a different avenue for training CR staff could be investigated. For example, a future applied research project could be training CR staff to teach participants self-management skills in comparison to staff who are untrained in teaching such skills.

Additional investigation into women-only CR may provide further insight into factors that promote adherence among women. A study similar to the one conducted by Midence et al (2016) could be improved through true randomization versus preferential randomization to the type of CR programming.

In addition to women-only CR programs, culturally appropriate programs could promote adherence among a wider population of Canadians that often do not utilize CR. Specific cultures may not participate in CR programs for reasons of education and language differences. Also, CACR guideline exercise and education practices have been developed for Canadians familiar with our culture without specific tailoring that may be needed for older adults from other

countries. However, culturally tailoring CR programs in areas where there are large numbers of individuals who are recommended for CR but don't engage for culture language and educational reasons cultural practices (e.g., Indian, Pan Pacific populations) may increase participation. Regardless, such tailored CR programs would still need to be mindful of the issue of proxy reliance.

Conclusion

It is clear that non-adherence to CR makes the health benefits of therapeutic exercise short-lived and problematic (Brawley et al., 2012). Combatting the problem of non-adherence is thus an important avenue to pursue for both asymptomatic as well as chronic disease and other at-risk populations such as CR participants. Examination of proxy reliance relative to adherence provides additional insight into the over-reliance phenomenon. In turn, these insights implicate possible consideration of interventions to combat over-reliance and increase patients' development of self-regulatory skills to SM-exercise post-CR.

The saying, "everything in moderation" may apply to the context of proxy reliance where helpful staff can be too helpful. Identification of a possible threshold in proxy reliance and how much is too much may provide insight into strategies to avoid over-reliance on CR staff in the future. Finding a balance between proxy reliance and patient responsibility is crucial for the maintenance of SM-exercise (cf. Gierc, Brawley & Rejeski, 2016).

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APPENDIX A

Note. The consent form covers more details and information than was used for this masters thesis as the thesis was part of a larger Royal University Hospital (RUH) foundation funded research grant. Not all measures in the grant were included in the thesis (i.e., exclusion of problem-solving purpose and measures). The study consent and demographics were only included in survey number 1.

STUDY CONSENT

Thank you for your participation in this research study about exercise and problem-solving. Please read this form carefully, and feel free to email or call the researchers with any questions you might have.

Researchers:

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Purpose and Procedure: The purpose of the study is to gain an understanding about individuals' problem-solving relative to their cardiac rehabilitation exercise. The study involves four short surveys, each of which will take approximately 10 to 20 minutes to complete. We will ask you a series of questions about your current exercise, problem-solving, and how you manage your cardiac rehabilitation exercise. Also, demographic information, which will be used to help describe individuals that do this study, will be asked on the survey. This information will not be used to discriminate against individuals wishing to participate in the study. In order to participate in this study, you must be enrolled in the cardiac rehabilitation program. We will ask you if you are interested/not interested in receiving a phone call from study personnel one year later in order to ask you about your cardiovascular health. This is not required, however, will be a chance for us to follow up on your progress and potentially help you overcome problems.

Potential Benefits: Although there are no known personal benefits to participating in this study, this research will improve our understanding of how individuals' problem-solving relates to their exercise behaviour. This knowledge may help us to better help people to overcome the challenges which they experience while trying to exercise regularly. All participants who complete the study will receive a \$5 honorarium as a token of our appreciation for their time. All participants will also have their names entered into 2 draws for a \$50 gift certificate to a restaurant of their choice

Potential Risks: There are no expected physical or psychological risks associated with participating in this study.

Storage of Data: All data will be stored securely at the University of Saskatchewan by the researchers. Paper copies will be stored in a locked file cabinet in our laboratory. Electronic documents will be copied onto an external hard drive and will be locked by password. Data may be stored on the university cabinet and, memory stick, and Dropbox, all of which are password-secured. Only the researchers will have access to the data. The data will be stored for a minimum of five years after completion of the study, after which time it will be destroyed appropriately by the researchers to ensure that the data cannot be recovered.

Confidentiality: Your confidentiality is assured because only researchers will have access to the information that you share. Any personally identifying information that you provide will not be linked to your study responses. You will be asked for your email address or phone number so that you may be entered into the draw and contacted if you win. Written reports of the data will be reported in aggregate/summarized form so that it will not be possible to identify individuals.

Right to Withdraw: Your participation is voluntary and you can answer only those questions that you are comfortable with. You may withdraw from the research project for any reason, without penalty of any sort. Should you choose to withdraw, we will ask you to complete a short exit survey by phone or in person so that we can document the reason for your dropout. If you choose to withdraw from the study, any survey responses that you provided will be destroyed upon your request. Once the data are entered, we will not be able to remove your data as your responses cannot be identified.

Questions: If you have any questions concerning the study, including questions on the survey, please feel free to contact the researchers at the phone numbers/email addresses provided above. The study has been approved on ethical grounds by the University of Saskatchewan's Behavioural Research Ethics Board on June 6, 2014. Any questions regarding your rights as a participant may be addressed to that committee through the Ethics Office, email: ethics.office@usask.ca, or call (306) 966-2975. Out of town participants may call toll free (888) 966-2975.

Consent to Participate: I have read and understood the description provided above. I have been provided with an opportunity to ask questions and my questions have been answered satisfactorily. I consent to participate in the study described above, understand that I may withdraw this consent at any time.

- ☐ Yes
- ☐ No

Signature

Date

Please indicate if you are interested/not interested in receiving a phone call from study personnel in one year in order to ask you about your cardiovascular health. This is not required, however, will be a chance for us to follow up on your progress and potentially help you overcome problems.

☐ Yes, you may call me

☐ No, please do not call me

If yes, please provide a contact number _____

Please indicate if you would like to receive information about future studies about cardiac rehabilitation exercise.

- ✓ Yes, I wish to receive information about future studies. Please email me at the following address.

Please indicate if you wish to receive a summary of the results of this study. You will be required to provide your email address. The summary will be emailed by the end of August, 2016.

- ✓ Yes, I wish to receive a summary of the results when they are ready. Please email them to the following address.

_____ ☐ same as above

Note. There were two copies of the consent form given to participants. One for the participant to return if they were interested in participating, and another for their own records of participation. Only one copy is included in the thesis for ease of reading and consideration of length.

Demographic Information

IMPORTANT: The information below is strictly for the purpose of describing participants in general. This information will be kept private. Please select only one answer unless otherwise specified.

1. How long have you been a cardiac rehabilitation program participant?

- ☐ Between 1 and 4 weeks (less than 1 month)
☐ Between 4 and 8 weeks (1 to 2 months)
☐ Between 8 and 12 weeks (2 to 3 months)
☐ Between 12 and 16 weeks (3 to 4 months)
☐ Between 16 and 20 weeks (4 to 5 months)
☐ Between 20 and 24 weeks (5 to 6 months)
☐ More than 6 months (please specify time) _____ (yrs / months)

2. Is this your first time attending cardiac rehabilitation?

- ☐ Yes ☐ No, I have attended cardiac rehabilitation in the past

3. Age: _____

4. Gender: ☐ Male ☐ Female

5. Height (feet): _____

6. Weight (kg): _____

7. Marital Status:

- ☐ Married ☐ Divorced ☐ Separated ☐ Single ☐ Widowed ☐ Common Law

8. Employment Status:

- ☐ Retired ☐ Homemaker ☐ Employed ☐ Unemployed ☐ Other (Specify) _____

9. Diagnoses: (Check all that apply)

- ☐ Myocardial Infarction ☐ Angina ☐ Bypass Surgery ☐ Angioplasty/angiogram
☐ Stent ☐ Other (Specify) _____

10. Number of cardiac episodes: _____

11. Health-related problems: (Check all that apply)

- ☐ Arthritis ☐ Asthma ☐ Diabetes ☐ High Blood Pressure ☐ High Cholesterol
☐ Any Cancer ☐ Stomach Problem ☐ Thyroid Problems ☐ Other (Specify) _____

12. Smoking Status:

- ☐ Never Smoked ☐ Past Smoker ☐ Current Smoker

13. Please provide your email address or phone number: _____

Your email or phone number is required for contact purposes only. This will be used to contact you regarding future surveys as part of this study, and if you wish to be included in the draw, however, it will not be linked to your responses so that your confidentiality is ensured.

Note. Items bolded indicate only those items used in the analyses of proxy reliance. This measure was only included on survey 1 and 2.

INSTRUCTOR RESPONSIBILITY

Knowing that various tasks in your cardiac rehabilitation exercise sessions are products of the participants', the instructor's, or joint efforts, use the scale provided to indicate how much responsibility you feel **the exercise instructor has** in managing these specific tasks during **your sessions**.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
No					Some					Complete
Responsibility					Responsibility					Responsibility

- | | |
|-------------------------------------------------------------|-------|
| 1. Managing the way time is used in the session | _____ |
| 2. Motivating you to achieve your exercise goals | _____ |
| 3. Selecting the exercises that you will do | _____ |
| 4. Determining how hard the exercise session will be | _____ |
| 5. Determining your satisfaction with the session | _____ |
| 6. Determining your feelings during the session | _____ |
| 7. Establishing exercise goals for the session | _____ |
| 8. Achieving your exercise goals | _____ |

CONFIDENCE TO EXERCISE

These questions are about management of your exercise participation. Please think of yourself and respond using the scale provided.

Using the scale provided, please rate your confidence for each of the following actions related to exercising *over the next 4 weeks*:

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
No					Some					Complete
Responsibility					Responsibility					Responsibility

Over the next 4 weeks, how confident are you that...

1. Over the next 4 weeks, how confident are you that you can arrange your weekly schedule in order to do your exercise no matter what? _____
2. Over the next 4 weeks, how confident are you that you will develop solutions to cope with **unexpected** barriers that can interfere with your exercise? _____
3. Over the next 4 weeks, how confident are you that you can make up times during the same week when you miss your exercise sessions? _____
4. Over the next 4 weeks, how confident are you that you will maintain your regular exercise frequency even though it may be difficult at times? _____
5. Over the next 4 weeks, how confident are you that you will resume your regular exercise frequency when it is interrupted and you miss exercise for a few days? _____
6. Over the next 4 weeks, how confident are you that you will develop plans for each exercise session to reach your desired level (i.e., intensity) of exercise? _____
7. Over the next 4 weeks, how confident are you that you can make a plan of action to maintain your current exercise frequency each week, **despite things that can prevent you from carrying out planned exercise**? _____
8. Over the next 4 weeks, how confident are you that you can prevent other things from interfering with your efforts to maintain your current exercise frequency each week? _____

VOLUME OF PHYSICAL ACTIVITY

Cardiac Rehabilitation (CR) Exercise

Think about your exercise over the past 2 weeks. We would like you to think about your exercise during a typical 7-day period. As an **ACCURATE REPORTING** of your exercise is one key to our research, please carefully read the following:

Please think about the exercise that you did **DURING CR EXERCISE SESSIONS FOR 20 MINUTES OR MORE.**

With this in mind, please think about 2 types of planned exercise: **(1) Moderate** and **(2) Vigorous.**

Moderate Exercise makes your heart beat faster and makes you breathe a little harder. You can **TALK EASILY** while doing moderate exercise, but you may not be able to sing comfortably.

Vigorous Exercise makes your heart beat much faster. You may **NOT BE ABLE TO TALK COMFORTABLY** without stopping to catch your breath.

Intensity can be estimated using a scale of 0 to 10, where **sitting is 0 and 10 is the highest level of effort possible. Moderate intensity exercise is a 5 or 6. Vigorous intensity exercise is a 7 or 8.**

Think about the last 2 weeks (14 days). Did you do any moderate or vigorous exercise for at least 20 minutes at one time during your CR exercise sessions?

Yes _____

No _____

On average, how many **days in each 7 day period** (1 week) did you actually do **MODERATE and/or VIGOROUS exercise for at least 20 continuous minutes during your CR exercise sessions?**

_____ (number of) days in a week

This measure continues on the next page.

How many TOTAL MINUTES were you doing
MODERATE and/or **VIGOROUS** exercise in a typical CR exercise session?

For example, you may have done two walks of 20 minutes each time during a day – so you would put 40 minutes below. Or you may have walked or done another type of moderate exercise for 35 minutes at one time – so you would put 35 below. We understand that you may not do the same amount of exercise on each day. We would like you to give us your best estimate of the average amount of time you exercised during CR exercise sessions. For example, if you did 40 minutes on one day and 30 minutes on another day, your average would be 35 minutes.

PLEASE ONLY COUNT THE EXERCISE ONCE AND DO NOT REPORT THE SAME EXERCISE TWICE. PLEASE ENSURE THAT THE TOTAL MINUTES REPORTED IN THE SECTIONS BELOW REFLECTS YOUR TOTAL EXERCISE MINUTES DURING CR EXERCISE SESSIONS DURING A TYPICAL WEEK.

Total minutes of MODERATE exercise in a typical CR session
(remember – only think about those times when you did 20 or more minutes) _____

Total minutes of VIGOROUS exercise in a typical CR session
(remember – only think about those times when you did 20 or more minutes) _____

PLANNED, SELF-MANAGED EXERCISE

Think about your exercise over the past 2 weeks. We would like you to think about your exercise during a typical 7-day period. As an **ACCURATE REPORTING** of your exercise is one key to our research, please carefully read the following:

Please think about the **PLANNED EXERCISE THAT YOU DID ON YOUR FREE TIME OUTSIDE OF CR exercise sessions FOR 20 MINUTES OR MORE**. This means that you scheduled/planned it and set time aside in your day to exercise.

Some examples of exercise: You may be registered in a swim/aerobics class at a local gym – this means that you have plans to exercise on each day that your class takes place in a week.

Exercise may also be planned when you get up in the morning – you notice it is nice outside and you plan to walk outside. **The KEY is that you plan to exercise in advance and set time aside in your free time to exercise for 20 minutes or more.**

We understand that you may do other types of exercise, like walking while doing groceries, have a physically demanding job, or you may do planned exercise for less than 20 minutes at one time. These types of exercise are not the focus of our research.

With this in mind, please think about 2 types of planned exercise: **(1) Moderate** and **(2) Vigorous**.

Moderate Exercise makes your heart beat faster and makes you breathe a little harder. You can **TALK EASILY** while doing moderate exercise, but you may not be able to sing comfortably.

Vigorous Exercise makes your heart beat much faster. You may **NOT BE ABLE TO TALK COMFORTABLY** without stopping to catch your breath.

Intensity can be estimated using a scale of 0 to 10, where **sitting is 0 and 10 is the highest level of effort possible**. **Moderate intensity exercise is a 5 or 6. Vigorous intensity exercise is a 7 or 8.**

Think about the last 2 weeks (14 days). Did you do any planned moderate or vigorous exercise for at least 20 minutes at one time during your free time **OUTSIDE OF CR EXERCISE SESSIONS**?

Yes _____

No _____

On average, how many **days in each 7 day period (1 week)** did you **actually do MODERATE and/or VIGOROUS exercise for at least 20 continuous minutes during your free time OUTSIDE OF CR EXERCISE SESSIONS**?

_____ (number of) days in a week

How many TOTAL MINUTES were you doing planned **MODERATE** and/or **VIGOROUS** exercise in a typical day **ON YOUR FREE TIME OUTSIDE OF CR EXERCISE SESSIONS?**

For example, you may have done two walks of 20 minutes each time during a day – so you would put 40 minutes below. Or you may have walked or done another type of moderate exercise for 35 minutes at one time – so you would put 35 below. We understand that you may not do the same amount of exercise on each day. We would like you to give us your best estimate of the average amount of time you exercised. For example, if you did 40 minutes on one day and 30 minutes on another day, your average would be 35 minutes.

PLEASE ONLY COUNT THE EXERCISE ONCE AND DO NOT REPORT THE SAME EXERCISE TWICE. PLEASE ENSURE THAT THE TOTAL MINUTES REPORTED IN THE SECTIONS BELOW REFLECTS YOUR TOTAL EXERCISE MINUTES THAT YOU DID IN YOUR FREE TIME OUTSIDE OF YOUR CR EXERCISE SESSIONS DURING A TYPICAL WEEK.

Total minutes of MODERATE exercise in a typical day
(remember – only think about those times when you did 20 or more minutes) _____

Total minutes of VIGOROUS exercise in a typical day
(remember – only think about those times when you did 20 or more minutes) _____

MOOD (HADS)

Please check the response that most describes you for each of the items below.

I feel tense or 'wound up':

- ☐ Most of the time
- ☐ A lot of the time
- ☐ From time to time, occasionally
- ☐ Not at all

I still enjoy the things I used to enjoy:

- ☐ Definitely as much
- ☐ Not quite so much
- ☐ Only a little
- ☐ Hardly at all

I get a sort of frightened feeling as if something awful is about to happen:

- ☐ Very definitely and quite badly
- ☐ Yes, but not too badly
- ☐ A little, but it doesn't worry me
- ☐ Not at all

I can laugh and see the funny side of things:

- ☐ As much as I always could
- ☐ Not quite so much now
- ☐ Definitely not so much now
- ☐ Not at all

Worrying thoughts go through my mind:

- ☐ A great deal of the time
- ☐ A lot of the time
- ☐ From time to time but not too often
- ☐ Only occasionally

I feel cheerful:

- ☐ Not at all
- ☐ Not often
- ☐ Sometimes
- ☐ Most of the time

Items continue on next page:

I can sit at ease and feel relaxed:

- ☐ Definitely
- ☐ Usually
- ☐ Not often
- ☐ Not at all

I feel as if I am slowed down:

- ☐ Nearly all the time
- ☐ Very often
- ☐ Sometimes
- ☐ Not at all

I get a sort of frightened feeling like 'butterflies' in the stomach:

- ☐ Not at all
- ☐ Occasionally
- ☐ Quite often
- ☐ Very often

I have lost interest in my appearance:

- ☐ Definitely
- ☐ I don't take so much care as I should
- ☐ I may not take quite as much care
- ☐ I take just as much care as ever

I feel restless as if I have to be on the move:

- ☐ Very much indeed
- ☐ Quite a lot
- ☐ Not very much
- ☐ Not at all

I look forward with enjoyment to things:

- ☐ As much as ever I did
- ☐ Rather less than I used to
- ☐ Definitely less than I used to
- ☐ Hardly at all

Items continue on next page.

I get sudden feelings of panic

- ☐ Very often indeed
- ☐ Quite often
- ☐ Not very often
- ☐ Not at all

I can enjoy a good book or radio or TV program

- ☐ Often
- ☐ Sometimes
- ☐ Not often
- ☐ Very seldom

EXERCISE DIFFICULTY

How difficult do you believe it would be to maintain your current exercise frequency on your own over the next 4 weeks?

1	2	3	4	5	6	7	8	9	10
Not at all				Somewhat					Extremely
Difficult				Difficult					Difficult

ANTICIPATED PERSISTENCE

INSTRUCTIONS: The following questions are about your thoughts related to maintaining your current volume of cardiac rehabilitation exercise without the help of the program staff.

How much **time** are you willing to put forth in order to maintain your current volume of cardiac rehabilitation exercise over the next 4 weeks?

1	2	3	4	5	6	7	8	9
Little or no time								As much time as it takes

How much **effort** you are willing to put forth in order to maintain your current volume of cardiac rehabilitation exercise over the next 4 weeks?

1	2	3	4	5	6	7	8	9
Little or no effort								As much effort as it takes

How willing are you **to persist** with maintaining your current volume of cardiac rehabilitation exercise over the next 4 weeks?

1	2	3	4	5	6	7	8	9
Will not persist at all								Will persist with strategies

How much of your **attention** are you willing to direct toward maintaining your current volume of cardiac rehabilitation exercise over the next 4 weeks?

1	2	3	4	5	6	7	8	9
Little to no attention toward this								Will direct complete attention toward this

Note. This measure was included in time 2, 3 and 4 surveys. The number of exercise options listed and the highlighted measure of individuals' confidence to pursue their top two activities (SRE-SM exercise) were the only measures used in the main analyses.

ALTERNATE ACTIVITY AFTER CARDIAC REHABILITATION

Please use the table ON THE NEXT PAGE to answer the following question.

First, list up to 15 of your options for exercising/being active on your own without the help of cardiac rehabilitation program staff following completion of the CARG program. Please provide as many options as you can think of.

THEN

For each of the alternative exercise options that you listed, please respond to these items in the table:

How confident are you that you could pursue a particular exercise option for the next 4 weeks?

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
No				Some					Complete	
Responsibility				Responsibility					Responsibility	

How satisfied do you anticipate being with this alternative activity choice for the next 4 weeks?

1	2	3	4	5	6	7	8	9
Very				Somewhat				Very
Dissatisfied				Satisfied				Satisfied

How difficult would it be to pursue this alternative activity choice for the next 4 weeks?

1	2	3	4	5	6	7	8	9	10
Not at all				Somewhat					Extremely

Exercise Options	Confidence to pursue this option (0 to 100%)	Satisfaction with this option (1 to 9)	Difficulty with this option (1 to 9)
EXAMPLE ROW: List Option	50	8	3
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			

APPENDIX B

Internal Consistency Reliabilities (Cronbach's α) for all Measures

Variable	Time 1	Time 2	Time 3	Time 4
^a SRE-SP	.854	.920	.944	.961
^b Persistence	.929	.921	.913	.969
^c Anxiety	.787	.802		
^d Depression	.794	.749		
^e Proxy Reliance	.915	.899		
^g Instructor Responsibility	.952	.949		

Note. All internal consistency reliabilities were acceptable ($\alpha > .7$); Tabachnick & Fidell, 2013). Time 3 & 4 assessments were outside the CRP by two weeks and 1 month, respectively. PA difficulty and the # of SM-activity options were not included as they were both 1-item measures.

^aSelf-regulatory efficacy = 8 items; ^bPersistence = 4 items; ^cAnxiety = 7 items; ^dDepression = 7 items; ^eProxy Reliance (Instructor) = 4 items; ^gInstructor Responsibility = 8 items.

APPENDIX C

Participant Characteristics of the Sample at CR Entry

Characteristic	Sample ($n = 89$)
Age (yrs)	64.5, $SD = 9.71$
BMI (kg/m^2)	29.42, $SD = 6.62$
Number of Comorbidities	2.0, $SD = 1.55$
Marital Status	
Married	77.5%
Employment Status	
Retired	57.3%
Employed	27%
Smoking Status	
Past Smoker	59.6%
Non-Smoker	34.8%
Condition Prior to CR	
Stent	50.6%
Bypass Surgery	27%
Angioplasty/Angiogram	27%
Myocardial Infarction (MI)	16.9%
^a Health-Related Problems	58.5%
High Blood Pressure	52.8%
High Cholesterol	47.2%
Arthritis	33.7%

Note: Participant characteristics are similar to previous study samples. ^aHealth-related problems other than those related to heart disease.

APPENDIX D

Comparisons Between Proxy Reliance Groups at 10-weeks of CR

		High Proxy Reliance		Low Proxy Reliance	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Social-Cognitive T2					
	SRE-SM	74.33	22.37	82.04	15.99
	exercise options				
	Exercise	3.69	2.77	4.31	2.51
	difficulty				
Behavioural T2					
	SM-exercise	82.41	92.8	90.8	81
	volume (min.)				
	CR-exercise	154	72.7	147.8	76
	volume (min.)				
	Number of SM-	3.19	3.39	4.04	2.39
	exercise options				
Social-Cognitive T4					
	Exercise	4.16	2.97	4.36	2.73
	difficulty				
Behavioural T4					
	Number of SM-	2.6	2.4	3.63	2.44
	exercise options				

Note. Group at T2, high proxy $n = 26$, low proxy $n = 22$. Groups at T4 high proxy $n = 18$, low proxy $n = 22$. SRE-SM exercise options was measured on a 0% (*not at all confident*) to 100% (*completely confident*) scale. Exercise difficulty was measured on a 1 (*not at all difficult*) to 10 (*extremely difficult*) scale. SM-exercise volume was calculated by multiplying the number of bouts reported by the average minutes of a typical bout to get participants total volume of exercise (in minutes) per week. The number of SM-exercise options participants reported was totalled and used as their score for analyses.